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The Effect of COVID-19 on Stock Prices of the Biotech Sector in Taiwan ROC

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Abstract

This study discusses the impact of COVID-19 on the biotech industry vs. TSEC Taiwan 50 Components stocks. We found that the price of stocks in the biotech sector in Taiwan increased due to the COVID-19 pandemic. The financial leverage ratio did not significantly affect the stock price of biotech companies during the COVID-19 pandemic. The number of confirmed diagnosed cases in Taiwan decreases the stock price of biotech companies, for high ROA. In contrast, the number of confirmed diagnosed cases in Taiwan increases the stock price of biotech companies, for high ROE. Investors have more confidence in the biotech firms with shareholder returns during the COVID-19 pandemic.

Keywords: COVID-19, ROA, ROE, Biotech

Introduction

Severe COVID-19 spread from Wuhan, China, to the world caused border blockades and shutdowns in February 2020, which interfered with the global production chain. Corbet, Hou, Hu, Oxley & Xu (2021) claim that the COVID-19 pandemic causes the stock market volatility in China, and there is spillover to Chinese gold and Chinese oil future. In March 2020, there was a major COVID-19 pandemic in the United States and Europe. It declined global economic growth. Izzeldin, Muradoğlu, Pappas and Sivaprasad (2021) claim that the healthcare and consumer service sector in G7 countries were the most severely affected, with the technology sector the least impacted. And they find that the COVID-19 pandemic effect on the stock market is similar to the financial crisis.

It maintains the harmony-labour relation Taiwan ROC has a lot of regulation about labour and employers, for the protection of employees for retirement ship, severance pay, maternity benefits and restriction on working hours (Lai & Masters, 2005; Lai & Sarkar, 2013, 2016, 2017). At the same time, Taiwan imports a lot of migrated workers from Asian countries (eg. Indonesia, Thailand, Philippine, Vietnam), or they move their factories to other areas with cheap labour to make up for the labour shortage in the manufacturing sector, construction and domestic workers, leading to wage gap based on gender and different skilled level (Lai, 2010, 2019, 2021, Lai & Sarkar, 2022). However, the COVID-19 pandemic prevents the flow of people and product transportation throughout the world; the closure of borders has led to a decrease in global consumption and a rise in unemployment in the world. The COVID-19 pandemic has had a significant impact on Taiwan's trade-oriented industrial economy.

This article uses the literature to show that the COVID-19 pandemic has a synergistic impact on TSEC weighted index (TWII). Recently, there has been a lot of literature (Ramelli & Wagner, 2020; Ding, Levine, Lin & Xie, 2021; Hong, Bian & Lee, 2021; Lai, Hu & Wang, 2021) discussing the impact of the COVID-19 pandemic, to trigger us to use the OLS regression model to discuss the impact of the COVID-19 pandemic on the stock price in Taiwan. This study focuses on the impact of the number of confirmed cases in Taiwan on the actual biotech stocks vs. TSEC Taiwan 50 Components stocks.

This study discusses the impact of the COVID-19 pandemic on biotech stocks vs. TSEC Taiwan 50 Components stocks, rather than the impact on the entire system. This

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study found that the higher the number of diagnoses, the higher the return on equity (ROE) and financial leverage ratio (LEV) will lower the stock price of the biotech company. On the contrary, the higher the number of diagnoses, the higher the return on assets (ROA) will increase the stock price of the biotech company.

Previous Studies

Concerning the impact of the COVID-19 pandemic on Taiwan's weighted stock index, recently, there have been a lot of literature discussions about the US. Liu, Huynh and Dai (2021) adopt the time-varying parameter vector autoregression model for the US data to show the positive effect of U.S. stock returns and crude oil returns during the outbreak of the COVID-19 pandemic in 2020. Hong et al. (2021) claim that the COVID-19 pandemic led to the stock market inefficiency, creating abnormal returns for stocks in S&P 500 and DJIA. Hsu, Hsu Kang (2020) claim that the US stock market and the China stock market would likely have had linage with the Taiwan stock market during the COVID-19 pandemic in 2020.

Regarding the industry sector, Mazur, Dang and Vega (2021) adopt Standard & Poor's 500 Index in the US; COVID-19 pandemic will significantly create high returns in the healthcare, food, natural gas, and software sectors. However, it creates a loss for crude oil, real estate, entertainment, and hospitality. Muradoğlu et al. (2021) claim that the healthcare and consumer service sector in G7 countries were the most severely affected, with the technology sector the least impacted. Höhler and Lansink (2021) find high stock price volatility in fertilisers, agrochemicals, and food distributors. However, the food retailers have low stock price volatility, because the demand for food retailers are stable during the COVID-19 pandemic. Corbet et al. (2021) and Liu et al. (2021) claim that the COVID-19 pandemic causes volatility in soybean, oil, gold, USD/CNY exchange rate, and bitcoin in China and the US. Narayan, Devpura and Wang (2020) also find that the COVID-19 pandemic causes volatility in USD/JPY exchange rate and the stock market in Japan.

Regarding the Taiwan stock market, Lai, Hu and Wang (2021) discovered the impact of the COVID-19 pandemic on Taiwan's stock prices. The impact was on Taiwan's 50 Chinese electronics stocks and financial stocks. Taiwan's 50 Chinese electronics stocks and financial stocks fell due to the COVID-19 pandemic and produced negative covariance, which means that stock prices have increased greatly due to the decline in the volatility of the COVID-19 pandemic. The COVID-19 pandemic has indeed caused the stock prices of TSEC Taiwan 50 Components stocks and financial stocks to fall, and the volatility of stock prices has increased significantly.

Data and Model

Based on the previous studies, we will use the biotech and TSEC Taiwan 50 Components stocks, with the daily closing stock price from March 6, 2020, to December 31, 2020, a total of 208 trading days. It contains 13,248 observations. This research uses OLS and backward eliminated regression to discuss the confirmed number of people diagnosed with COVID-19 in Taiwan and how the company's financial statements, exchange rates, biotech stocks, and the U.S. stock market will impact the stock prices in Taiwan (Hsu et al, 2020).

The research data come from Taiwan Stock Exchange Corporation (TWSE, source: ww.twse.com.tw) and includes the daily stock price of 64 firms, ten typical anti-COVID-19 pandemic biotech industries stocks (N95, surgical masks, and biomedical industries)[1] and 54 firms of the TSEC Taiwan 50 Components stocks. There are 54 stocks in total, including 14 financial industries stocks, 19 electronic industries stocks, three communication industries stocks, and 18 conventional industries stocks.[2]

[1] The company code for N95 and surgical masks industries stocks (five firms): 9103, 1325, 9919, 9944, and 6504. The company code for biomedical industries stocks (five firms): 4142, 6547, 3373, 1799, and 4735.

[2] The company code for financial industries stocks (14 firms): 2801, 2880, 2881, 2882, 2883, 2884, 2885, 2886, 2887, 2890, 2891, 2892, 5876, and 5880. The company code for electronics industries stocks (19 firms): 1590, 2303, 2308, 2317, 2327, 2330, 2352, 2379, 2382, 2395, 2408, 2454, 2474, 3008, 3034, 3711, 4938, 6415, and 6669. The company code for communication industries stocks (three firms) 2412, 3045, and 4904. The company code for conventional industries stocks (18 firms): 1101, 1102, 1216, 1301, 1303, 1326, 1402, 2002, 2105, 2207, 2227, 2609, 2610, 2633, 2912, 5871, 6505, and 9910.

$$P_{it} = a_0 + a_1 CVD_{it} + a_2 Ind_{it} + a_3 EXR_{it} + b_1 \sum_{i=1}^{3} F_{it} + b_2 \sum_{i=1}^{2} S_{it} + c_1 CVD_t \times \sum_{i=1}^{3} F_{it} + c_2 CVD_t \times Ind_{it} + d_1 CVD_t \times \sum_{i=1}^{3} F_{it} \times Ind_{it} + \mu \quad (1)$$

$$P_{it} = a_0 + a_1 CVD_{it} + a_2 Ind_{it} + a_3 EXR_{it} + b_1 \sum_{i=1}^{3} F_{it} + b_2 \sum_{i=1}^{2} S_{it} + c_1 CVD_t \times \sum_{i=1}^{3} F_{it} + c_2 CVD_t \times Ind_{it} + c_3 CVD_t \times \sum_{i=1}^{2} S_{it} + d_1 CVD_t \times \sum_{i=1}^{3} F_{it} \times Ind_{it} + \mu \quad (2)$$

As seen in Table 1, the dependent variable for daily 1000 stock price adjusted by US dollar P_{it} in Equation (1) and (2) is the daily closing stock price of all stocks –TSEC Taiwan 50 Components and biotech stocks. The independent variables include the three financial statement variables) during the period of all stocks of the TSEC Taiwan 50 Components. It includes the return on equity (ROE_t), return on assets (ROA_{it}), and the financial leverage ratio with equity multiplier (LEV_{it}). Hsu et al. (2020) claim that the US market will affect the Taiwan stock market; the model will include three index of US stock market , Nasdaq Index (NAS_t), and Dow Jones Industrial Average Index (DJI_t) (Narayan et al., 2020). The U.S. dollar transfer currency exchange rate (EXR_t) will be affected by the COVID-19 pandemic. The key independent variable of the model is the number of confirmed diagnoses announced on the trading day (CVD_t) and industrial dummy variable for biotech Ind_{it} (using the biotech component stocks as 1 and the others as 0).

The second level of regression includes the multiple of the number of confirmed diagnoses announced on the trading day CVD_t and the financial statements index ($\sum_{i=1}^{3} F_{it}$), and industry variables ROE_{it}, ROA_{it}, LEV_{it}, and Ind_{it} ($CVD_t \times ROE_{it}$, $CVD_t \times ROA_{it}$, $CVD_t \times LEV_{it}$, and $CVD_t \times Ind_{it}$).

Regarding the relationship with the US stock market, the multiple of CVD, the two index of US stock market ($\sum_{i=1}^{2} S_{it}$) ($CVD_t \times \sum_{i=1}^{2} S_{it}$), can measure the effect of COVID-19 pandemic between Taiwan and the US stock market in Equation (2). Finally, the multiple of the number of confirmed diagnoses announced on the trading day CVD_t, industry variable Ind_{it}, and financial statement index ($\sum_{i=1}^{3} F_{it}$) ROE_{it}, ROA_{it}, and LEV_{it} ($CVD_t \times ROE_{it} \times Ind_{it}$, $CVD_t \times ROA_{it} \times Ind_{it}$, and $CVD_t \times LEV_{it} \times Ind_{it}$) can measure the effect of COVID-19 pandemic and the financial statement index on stock price of the biotech sector.

Empirical Result

In Table 2 (as seen in column 1-2 A&B of Table 2), the share prices of biotech and TSEC Taiwan 50 Components stocks are not significantly correlated with CVD_t, indicating that the number of confirmed diagnoses, CVD_t, in a single day, is relatively unrelated to stock prices. The share prices of biotech and TSEC Taiwan 50 Components stocks, and ROE_{it} and LEV_{it} are negatively significant, but they are positively significant with ROA_{it} (as seen in column 1-2 A&B of Table 2). The table shows that ROA_{it}, ROE_{it}, and LEV_{it} are extremely significant in terms of stock prices. At the same time, as ROA_{it} increases, the share prices of biotech and TSEC Taiwan 50 Components stocks will increase; however, when ROE_{it} and LEV_{it} increase, the share prices of biotech and TSEC Taiwan 50 Components stocks will decrease. The share prices of biotech and TSEC Taiwan 50 Components stocks, and the dummy variable (Ind_{it}) of the biotech industry show negative signs (as seen in column 1-2 A&B of Table 2). The share prices of the biotech sector in Taiwan are negative. On the other hand, (as seen in column A of Table 2), the Dow Jones Industrial Average (DJI_t), the US dollar to Taiwan dollar exchange rate (EXR_t), the confirmed number of people diagnosed in a single day, and the Nasdaq index are all insignificant. It shows that these independent variables do not determine the stock price trend, and their influence is extremely small. However, according to the backward eliminated method (as seen in column 1-2 B of Table 2), the Nasdaq Index (NAS_t) will have a positive significant relationship with the price of biotech and TSEC Taiwan 50 Components stocks, rather than other US stock market benchmark.

Judging from the empirical results of biotech and TSEC Taiwan 50 Components, we found that among 54 companies, the high ROA_{it} of biotech stocks found that the stock price return rate was higher during the COVID-19 pandemic peak. However, this means that biotech stocks, with the COVID-19 pandemic and high asset investment rate (before COVID-19 pandemic), have a better performance than the transmission of assets. In contrast, biotech companies with poor financial statements will not have good stock prices. Biotech stocks with high ROE_{it} did not perform well during the COVID-19 pandemic. The capital investment rate continued under

the COVID-19 pandemic, but it was more confident and attractive to investors, not just stock investment rate data.

As seen in column 1-2 A&B of Table 2, the multiple of the number of confirmed diagnoses (CVD_t) and the return on equity (ROE_{it}) are negatively significant for the share prices of biotech and TSEC Taiwan 50 Components stocks (as seen in column 1-2 A&B of Table 2 of the coefficient of $CVD_t \times ROE_{it}$). However, the multiple of the number of confirmed diagnoses (CVD_t), for the return on assets (ROA_{it}) and the financial leverage ratio (LEV_{it}) ($CVD_t \times ROA_{it}$ and $CVD_t \times LEV_{it}$), is positively significant for the share price of biotech and TSEC Taiwan 50 Components stocks in Taiwan. The multiple of the number of confirmed diagnoses (CVD_t) and the industry dummy variable (Ind_{it}) of biotech show a positive coefficient of $CVD_t \times Ind_{it}$, indicating that the price of stocks of the biotech sector in Taiwan increased due to the COVID-19 pandemic.

This means that the higher the number of confirmed diagnoses (CVD_t), with high return on equity (ROE_{it}), the lower the share price of biotech and TSEC Taiwan 50 Components companies ($CVD_t \times ROE_{it}$). On the contrary, the higher the number of confirmed diagnoses (CVD_t), the higher the return on assets (ROA_{it}) and the financial leverage ratio (LEV_{it}) lead to higher stock prices for biotech and TSEC Taiwan 50 Components companies ($CVD_t \times ROA_{it}$ and $CVD_t \times LEV_{it}$).

Finally, as seen in column 1-2 A&B of Table 2, the multiple of number of confirmed diagnoses (CVD_t), the return on equity (ROE_{it}), and the industry dummy variable of biotech (Ind_{it}) ($CVD_t \times ROE_{it} \times Ind_{it}$). The stock price is significantly positive. This means that the higher the number of confirmed diagnoses (CVD_t), the higher the return on equity (ROE_{it}) will increase stock prices of the biotech sector during the COVID-19 pandemic.

However, as seen in column 1-2 A&B of Table 2, the multiple of number of confirmed diagnoses (CVD_t), the return on assets (ROA_{it}), and the industry dummy variable of biotech (Ind_{it}) ($CVD_t \times ROA_{it} \times Ind_{it}$) have negative significant effects on the stock prices of biotech firms. The higher the number of confirmed diagnoses (CVD_t), the higher the return on assets (ROA_{it}) will reduce stock prices of biotech companies during the COVID-19 pandemic.

The backward eliminate method will support that higher the number of confirmed diagnoses (CVD_t), the higher the return on equity (ROE_{it}) will increase stock prices of biotech companies, rather than higher the return on assets (ROA_{it}).

Conclusion

Based on the empirical results of biotech and TSEC Taiwan 50 Components stock, we found that the stock price of the biotech industry was affected by the COVID-19 pandemic. The financial leverage ratio did not significantly affect the stock price of biotech companies during the COVID-19 pandemic. The stock price of biotech firms will increase when more people confined COVID-19. It corresponds to the findings of Mazur et al. (2021) and Muradoğlu et al. (2021), that is, the COVID-19 pandemic will boost the stock price of healthcare. The investors should buy biotech stocks with high ROE_{it}, and they can earn high returns when the COVID-19 pandemic. Investors have more confidence in the biotech firms with high return on equity rather than returns on asset during the COVID-19 pandemic.

On the other hand, we find that Nasdaq Index (NAS_t) in the US stock market likely had linage with the Taiwan stock market during the COVID-19 pandemic in 2020. It corresponds to the findings of Hsu et al. (2020). We also do not find that the US dollar to Taiwan dollar exchange rate (EXR_t) affects the stock price of biotech and TSEC Taiwan 50 Components stocks (Narayan et al., 2020).

Table 1: The Statistics for Variables

	Min.	*Max.*	*Means*	*Std. Dev.*
Dependent Variable				
Pit = Daily end 1000 stock price by USD	109	150884	6736.67	17206.339
Independent Variable				
CVDt = The daily number of COVID-19 confirmed diagnoses case	0	27	2.37	4.62
ROEit = Rate of return of equity	−0.13	0.69	0.05	0.08
ROAit = Rate of return of asset	−0.08	0.5	0.03	0.05
LEVit = The leverage (Equity of Multiplier)	−2.69	36.80	5.05	5.76
NASt = The daily NASDAQ Composite Index	6860	12899	10431	1534
DJIt = The daily Dow Jones Industrial Average Index	18591	30606	26619	2578
EXRt = Daily exchange rate NTD/USD	28.68	30.71	29.7	0.53
INDit = The industry dummy variable for biotech	0	1	0.16	0.36

Table 2: The OLS Results

	OLS		*Backward Eliminated*	
	(1A)	*(2A)*	*(1B)*	*(2B)*
Constant	−8436(25122)	2701(25922)	8720(1063)***	5997(1305)***
CVD_t	−782(62)***	−6422(1838)***	−775(59)***	−6815(1680)***
ROE_{it}	−47969(5931)***	−49545(5948)**	−47415(5919)***	−49399(5942)***
ROA_{it}	98359(9272)***	100299(9286)***	97452(9251)***	99864(9271)***
LEV_{it}	−577(30)***	−577(30)***	−578(30)***	−578(29)***
DJI_t	−0.294(0.270)	−0.007(0.283)	Delete	Delete
NAS_t	0.885(0.504)	0.522(0.524)	0.211(0.098)***	0.486(0.124)***
EXR_t	605(748)	106(779)	Delete	Delete
IND_{it}	−8232(488)***	−8196(488)***	−8218(487)***	−8169(487)***
CVD_txROE_{it}	−8254(1496)***	−7678(1505)***	−8354(1494)***	−7690(1504)***
CVD_txROA_{it}	52846(3356)***	53360(3358)***	52822(3355)***	53338(3357)***
CVD_txLEV_{it}	61(6.699)***	63.284(6.719)***	61(6.694)***	63(6.713)***
CVD_txIND_{it}	906(305)***	964(306)***	720(101)***	737(101)***
CVD_txDJI_t		0.098(0.149)		Delete
CVD_txNAS_t		184(61)***		199(55)***
CVD_txROE_{it}xIND_{it}	17727(3403)***	17959(3403)***	16422(2702)***	16318(2700)***
CVD_txROA_{it}xIND_{it}	−70064(5730)***	−71682(5747)***	−67854(4697)***	−69064(4706)***
CVD_txLEV_{it}xIND_{it}	−97(151)	−119(152)	Delete	Delete
R square	0.101	0.103	0.102	0.102
F value	100	89.6	126	117
Sample Size	13248	13248	13248	13248

Note: (1) Significant level < 1%***, < 5%**, < 10%*. (2) The coefficient comes from Equations 1 & 2. Column 1A and 1B calculated from Equation 1 and Column 2A and 2B calculated from Equation 2. Inside the parentheses is standard deviation.

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